

Appendix 4.1

Project Report

Title: Karaba oil (Crabwood oil): a literature review

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LITERATURE REVIEW – Karaba oil (Crabwood oil)

Introduction

Crabwood oil is produced in Guyana from the seeds of the Crabwood tree (*Carapa guianensis*), which is common to seasonally inundated forests. A member of the Meliaceae family, *C. guianensis* is widely distributed throughout eastern Amazonia, the Guianas, Trinidad and Central America (up to Nicaragua). It is found throughout Guyana, predominantly in the marsh lands or on the hydromorphic soils of the Cuyuni-Supenaam Region (Thomas and Hammond 2000). Large numbers can be found across the entire country, particularly in swamp locations or those areas influenced by hydromorphic soils. The highest densities appear to be found in the Cuyuni-Supenaam region (Roth 1946).

Oil derived from the seeds of the Crabwood tree is known throughout the Amazon Region by various names. In the indigenous languages of the Arawak, Patamona and Akawaio populations of Guyana, it is known as Karaba oil (Polak 1992.) However, in wider Guyana it is commonly referred to by its creole name, Crab oil (Fanshawe 1950, also see van Andel, 2000). In Brazil, Europe and North America it is traded under the name Andiroba oil (www.rain-tree.com/andiroba.html)² and in French Guiana, Carapa oil (Abulet; 1775; Plotkin, MJ *et al.*, 1991).

Characteristics & Properties

Botanical characteristics

Crabwood is a canopy and sub-canopy tree (Thomas and Hammond 2000) with a heavy oval crown and a slightly buttressed base (Thomas and Hammond 2000; Fanshawe 1961; Payne 2001). It has large, alternate, paripinnately compound leaves likely in terminal fascicles, the main vein of which is prominent on the underside. Immature branches are course and "rofuscous-brown" (Latchman-White 1992). The bark ranges from gray to brown-brown and may be smooth or flaky. The flowers are small and white, sessiled in spike-like axillaries or terminal panicles and the fruit is a woody 4-valved capsule with prominent valve edges and a cluster of 2-12 angled light brown-reddish seeds (Thomas and Hammond 2000; Polak 1992). Flowering occurs mainly in the November-February period and fruiting in the April-July (Polak 1992). The tree grows to a diameter of 72 inches and a height of 170 feet (Fanshawe 1961); those 60-100 dbh yield between 2000-4000 seeds (Janzen *et al.* 1983).

Oil

Physical appearance

Due to the variation in its extraction method, the appearance of crab oil varies from producer to producer. Its colour at ambient temperature is known to range from cream (Fanshawe, 1950), to yellow-orange (www.greencottage.com/iols/andiroba.html)³, to red (www.rain-tree.com/andiroba.html). The more consistent properties include a high viscosity and bitter taste (Fanshawe, 1950; Abulet, 1775; Plotkin, MJ *et al.*, 1991).

Chemical properties

Fanshawe (1950) reports:

¹ Article quoted from Leslie Taylor's Herbal Secrets of The Rainforest

² Article quoted from Leslie Taylor's Herbal Secrets of The Rainforest

³ Reproduction of L'Ami des ingrédients Naturel, l'encyclopédie

Specific gravity @100/15 °C	0.857-0.922
Refractive index @40 °C	1.4560-1.4593
Solidifying point of fatty acids	35.8-37.8°C
Acid value	22-37
Saponification value	195.5-198.5
Iodine value (Hubl. 17 hrs) at 57-65%	
Unsaponifiable matter at 0.6-1.1%	

Recent recordings on www.greencottage.com/iols/andiroba.html, show a refractive index of 1.4632-1.4710 at a temperature of 20 °C (consistent with the Fanshawe (1950) report), a less specific acid value of <100 and peroxide value of <15.0 meq. Additionally, an unsaponifiable matter of as much as 5% was reported.

Chemical composition

The unsaponifiable portion of the oil contains the liminoids and triterpenes. These liminoids and their average portions are:

Palmitic acid	28%
Palmitoleic acid	1%
Stearic acid	8.1%
Oleic acid	50.5%
Linoleic acid	9%
Arachidic	1.2%
Linolenic	0.3%

(www.greencottage.com/iols/andiroba.html; www.rain-tree.com/andiroba.htm).

Present are the melacins or oxygenated terpenes, 11-beta-acetoxy-gedunin, 6-alpha-acetoxy-gedunin, 6-beta-acetoxy-gedunin, 6alpha, 11-beta-diacetoxy-gedunin, 6-alpha-hydroxy-gedunin, 6beta, 11-beta-diacetoxy-gedunin, 7-deacetoxy-7-oxogedunin, 7-desacetoxy-7-ketogedunin and Andirobin, which are accountable for the oil's bitterness. The content of low free fatty acid is as high as 0.99%. (www.rain-tree.com/andiroba.htm).

These terpenes, held in the unsaponifiable portion of the oil, are responsible for its anti-inflammatory property. Crab oil also possesses the properties of an antiseptic, antiparasitic, emollient and cicatrizant (www.rain-tree.com/andiroba.htm). These have given rise to the immeasurable curative value of the oil.

Timber

Crabwood has familial associations with the true neotropical (*Swietenia* spp.) and African (*Entandrophragma* spp.) mahoganies (Thomas and Hammond 2000). Considered a hardwood, it is of medium to coarse texture, usually with straight grains, with a nominal density of 0.67 g cm⁻³ (Thomas and Hammond 2000; Brunner *et al* 1994). The wood varies in colour along the spectrum of pale pink to dark brown with black streaks with the sapwood falling at the lighter end of the spectrum and the heartwood at the darker (Fanshawe 1961; Polak 1992; Brunner *et al* 1994). It is termite and fire resistant (Fanshawe 1961).

Crabwood oil extraction process

Irrespective of where in the Amazon scientists have visited or which tribe or group of persons is involved in its production, the method of extraction of Crab oil is noticeably primitive and similar. The seeds are collected, boiled in a pot of water and left for several days to decompose. They are then individually cut and their endocarp or kernels removed. The kernels are then crushed and

molded into a paste, placed in a container and left in the sun. The sun's heat melts the paste to the extent that it oozes its oil content (Abulet, 1775; Fanshawe, 1950; Plotkin, MJ *et al.*, 1991; van AnDEL, 2000). The estimated time the boiled seeds are left to decompose ranges from 2 to 8 weeks (Fanshawe, 1950, van AnDEL, 2000). The paste can also be squeezed by a *matapi* (Reinders, 1993; van AnDEL, 2000).

An alternative approach employed in the production of Karaba oil involves the drying and peeling of the seeds that are then grated and soaked in boiling water. The boiled seeds are squeezed with the bare hands or in a piece of cloth and the remaining oily liquid is then boiled for approximately two hours. The oil, which floats to the top, is scooped off and bottled (Reinders 1993; van AnDEL 2000).

In Brazil, upon completion of the two-week decomposition phase, the entire Crabwood seed is crushed, skin and all. The grinding of the seed skin accounts for the red colouring in the oil (www.rain-tree.com/andiroba.htm, (www.andiroba.com.br/ingles.html)⁴. The elimination of the pulp-removal stage renders this method less painstaking and time-consuming.

Instruments employed to crush the kernels vary from stones, to a pestel and mortar (Abulet, 1775; Plotkin MJ *et al.*, 1991) to a *tipiti* (www.rain-tree.com/andiroba.htm). In the absence of the sun, there is also the option of using a small furnace to heat the paste (Abulet, 1775; Plotkin MJ *et al.*, 1991). At this very stage, the Galibis of French Guiana, alternatively, place the kernel paste on flat stones hallowed to form a gutter to facilitate the outflow of oil, while the Wayapis use inclined trunks of the palm tree (www.greencottage.com/iols/andiroba.html).

Marketing and prices

Crabwood Oil

Commercialization of Crab oil has spread through the countries of the Amazon Region. In spite of its complicated method of processing, communities of rural Guyana have deemed the oil a worthwhile income-generating commodity. one of only a few herbal medicines traded in the interior, it is sold for as little as US\$3.50 per litre. In the non-interior communities and towns, however, the price of the same quantity of oil is as high as US\$7.00 (van AnDEL, 2000).

Further afield, capitalizing on the salability of 100% natural Amazonian Forest products, and to a greater extent, the cultivation of a "sustainable ecological conscience," there has been a surge in industrialized production of the oil. Mixed with Copaiba, Lavender and Citronella oils, it is marketed as a cicatrizant, a "relaxing, soft phytorepellant" and a "strong combination repellent" respectively. With Arnica and Rosemary oils, it is touted as a trauma, massage and anti-rheumatic ointment. Further, the oil is processed and sold as insect repelling, non-toxic, odorless candles, torches and soaps (www.andiroba.com.br/ingles.html). Andiroba oil, in its virgin but solid state, is sold in various quantities at prices ranging from US\$2.90 per ounce to US\$30.00 per pound. One bottle of 60 Andiroba gel caps is sold at US\$57.60. (<http://rain-tree.com/prices.htm>).

Fanshawe (1950) envisaged no commercial future for Crab oil in Guyana, van AnDEL (2000), however, suggests that attempts are currently being made to process Crab oil into soap, candle and insect repellent.

Timber

Crabwood exploitation in Guyana dates back to the 19th century. GFC Market & Production Report of 1998 recorded that up until 1990 its lumber production was surpassed only by that of Greenheart and Mora (*Mora excelsa*). Straight grains result in an excellent finish which is partly why the wood is used for interior joinery. van AnDEL (1998) opined that though local and foreign

⁴ Natu.Science Fitorepelentes site

demand for the wood are high, volume losses due to moisture stress and frequent end checking may render *in situ* milling uneconomical. Prices of crabwood range from 100-115 US\$ m⁻³ roundwood and in 1998 it ranked 5th in timber production within Guyana (Thomas and Hammond 2000). Stabroek News of May 9th 2000 reported that there are log export restrictions on the species due to shortage on the local market (Payne 2001).

Uses

Oil

Medicinal. In the North-West district of Guyana, *Carapa guianensis* is among the most “widely used” of the medicinal plants and is employed to cure as many as 15 ailments. Included in these are *coughs and colds, whooping cough, groin rupture, hemorrhoids, skin problems (i.e. insect bites, sores, thrush in babies, wounds and bruises, dry cracked skin, itching, skin diseases and painful swellings), malaria, pneumonia and asthma; it is also used as an insect repellent (for mosquitoes, beet rouge, ticks etc)* (van Anel, 2000). Additional reports have expanded this list to include *internal cancers, lice and tick infestation of the hair, muscle pain, psoriasis, sore feet, arthritis, flu, fever, leprosy, herpes, ulcers, tetanus* with general uses as a *parasiticide, pediculicide, vermifuge, insecticide, insectifuge and allergenic* (www.rain-tree.com/andiroba.htm). Though not backed up by any other writing covered by this review, Natu.Science Fitorepelentes’ report has stated that Crab oil (Andiroba Oil) is also “effective” in combating *protozoan, hepatitis, liver infection, kidney infection, tapeworm, jaundice, mycosis and dyspepsia* (www.andiroba.com.br/ingles.html). Krompegel (2000), in her paper “*Ethnobotany of Two Contrasting Ecosystems: Amazonia and Sonoran Deserts*”, identified additional “ethno medical” uses: *remedying throat inflammation, ear infection and vaginal pain* (www.colostate.edu/Depts/Entomology/courses/en570/papers_2000/krpompegel.html); Sullivan (1999) has noted its anti-diarrheal employment. The studies of Reinders (1993), Abulet (1775), Lachman-White (1992) and L’Ami des ingrédients Naturel, l’encyclopedie -as reported on (www.greencottage.com/iols/andiroba.html)-all to varying degrees, endorse these claims.

Cosmetic. Investigations into the cosmetic value or usefulness of Crab oil is based to the high presence of linoleic and oleic acids in seed of the Crabwood tree. “Linoleic acid would be the main fatty acid involved in maintaining the epidermis integrity..... It (Crab oil) can thus be used in all skin care products, particularly: creams for dry, hydrated or atonic skins; anti-wrinkle products; skin restructuring emulsions and body lotions.” ([file:///herbsandmedicinal plants.html](file:///herbsandmedicinal%20plants.html)); www.greencottage.com/iols/andiroba.html).

In April 1998 a US patent was filed for an “invention” (a lipid extracted from the seed of Crabwood tree) for the preventative treatment of cellulite. More precisely, the inventors Rouillard, Crepin and Saintigny, claimed that they held, among other things, “a method for inhibiting glucose 6-phosphate dehydrogenase in adipocytes, which comprises: applying to a skin a cosmetic or pharmaceutical composition comprising 0.01-100% by weight of a lipid extract of Andiroba.” (US Patent and Trademark Office: Full Patent Text and Database, 1999). Presented were possible compositions for an aqueous gel, body oil, lotion, stick and O/W emulsion.

Crab oil is applied to the hair to add luster and sheen (www.rain-tree.com/andiroba.htm). It is also used in scar reduction and as an astringent (www.andiroba.com.br/ingles.html).

Other uses. Apart from the medicinal and cosmetic uses, Crab oil is employed as furniture oil as well as a solvent for the extraction of plant colourants. The Munduruku Indians of Brazil used the oil to preserve human heads taken in war (www.andiroba.com.br/ingles.html; www.rain-tree.com/andiroba.htm).

Timber

Often combined with kufa (*Clusia* spp.), Nibbi (*Heteropsis* spp.) and Tibisiri (*Mauritia flexuosa*), Crabwood is used primarily in the making of interior joinery (i.e. cabinetry, tables and shelving) or as a sliced or peeled decorative veneer (Thomas and Hammond 2000). Aublet’s writings reveal

the use of the tree trunk in the making of masts by French Guiana boating industry in the 1700's (Plotkin MJ *et al.*, 1991).

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